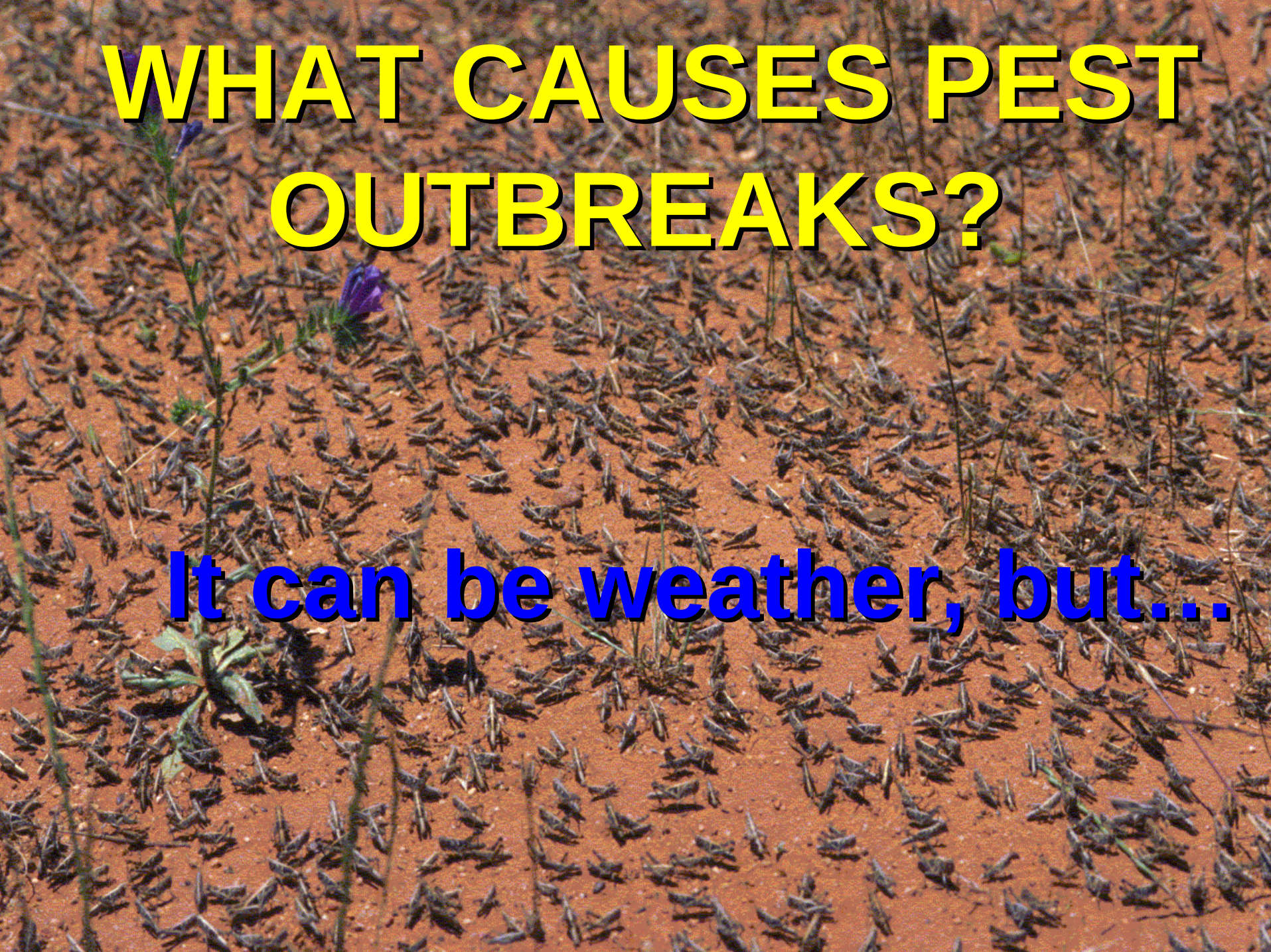
Pest Management and IWM Planning

USDA-NRCS

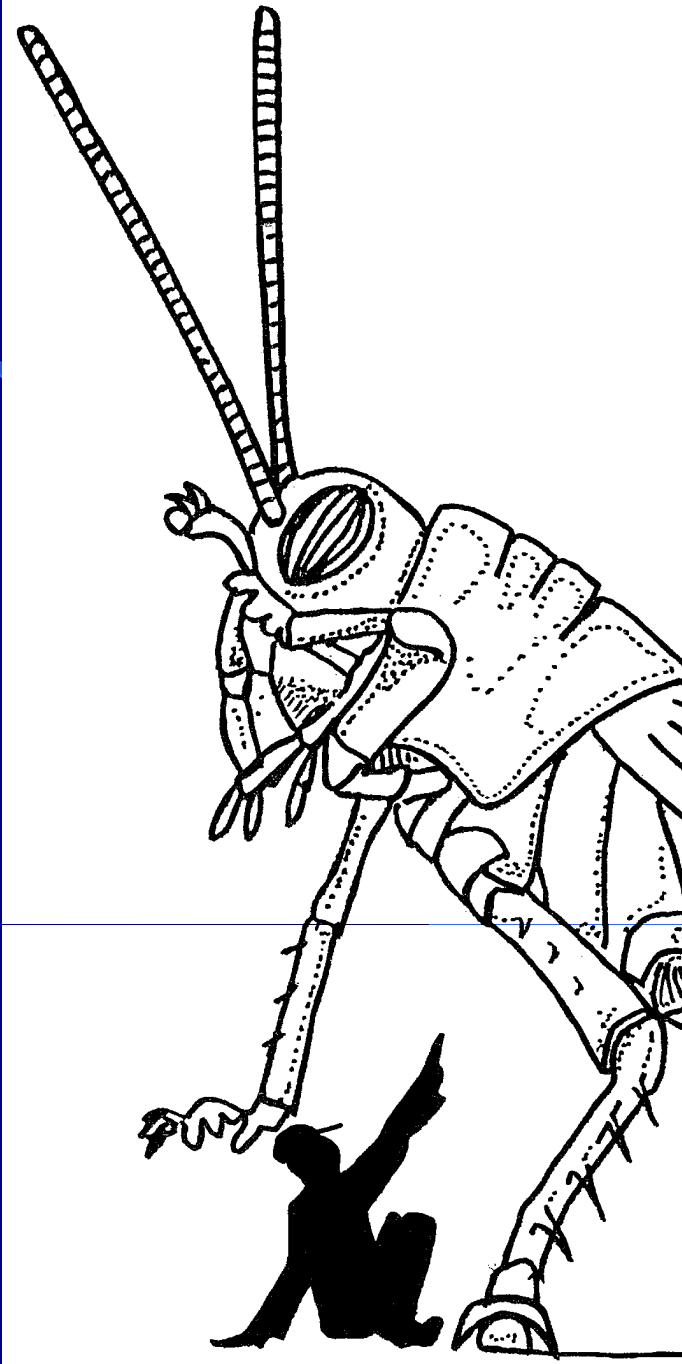
IWM Workshops

(Adapted from NRCS Core 4, NM NRCS Pest Management Planning Course, and Alex Latchininsky, Pests of Field Crops in Wyoming, Univ. Wyoming, Jun. 2006 ppt)


WHAT CAUSES PEST OUTBREAKS?
It can be weather, but…

… Frequently it's our own fault …

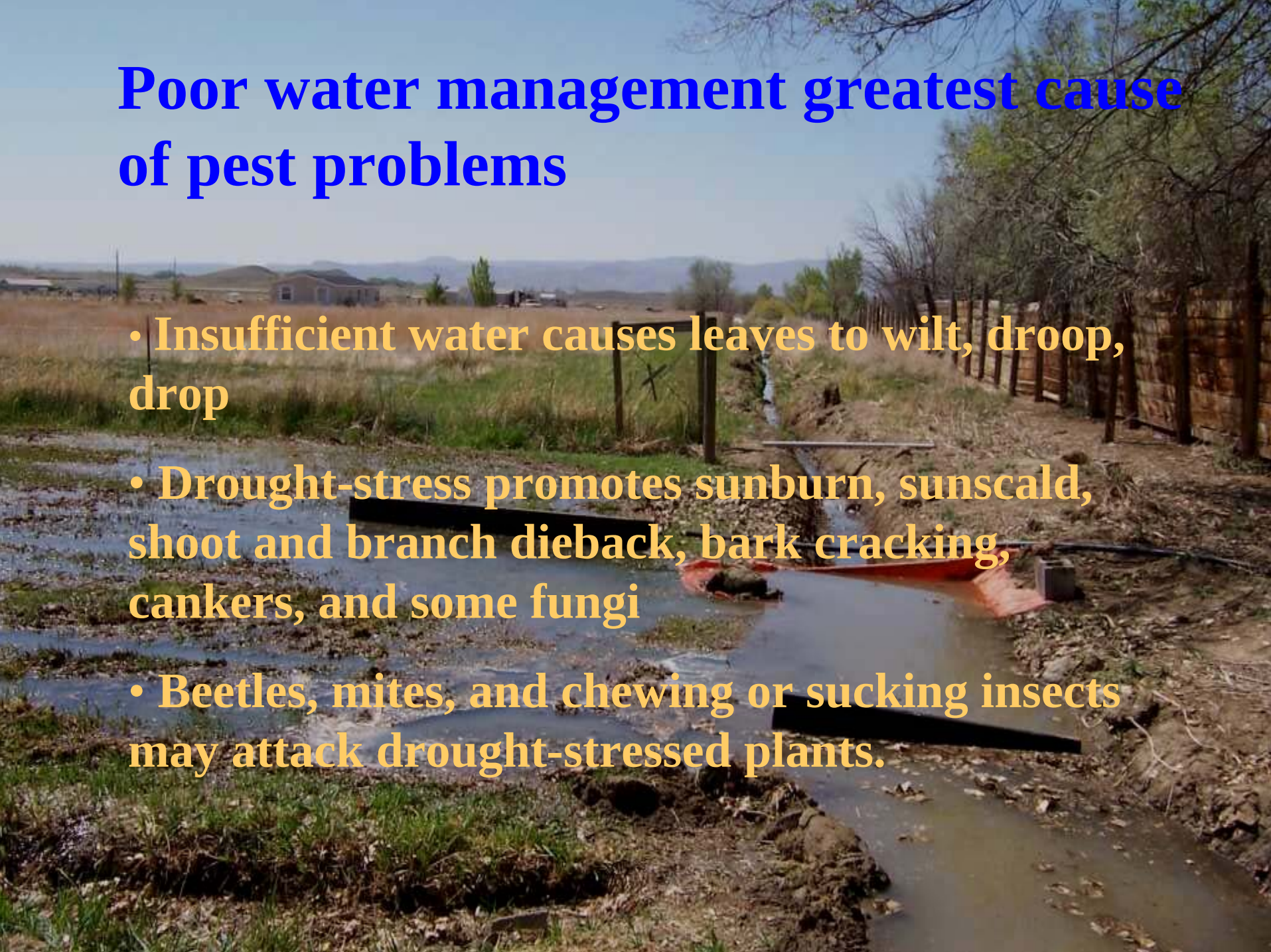
- Large-scale monocultures
- Poor cultural practices
- Overuse of pesticides (killing natural enemies)
- Pest introduction in the new environment
- Disruption of a natural equilibrium



DEFINITIONS

Pest Management: Utilizing environmentally sensitive prevention, avoidance, monitoring and suppression strategies to manage weeds, insects, diseases, animals and other organisms (including invasive and non-invasive species) that directly or indirectly cause damage or annoyance.

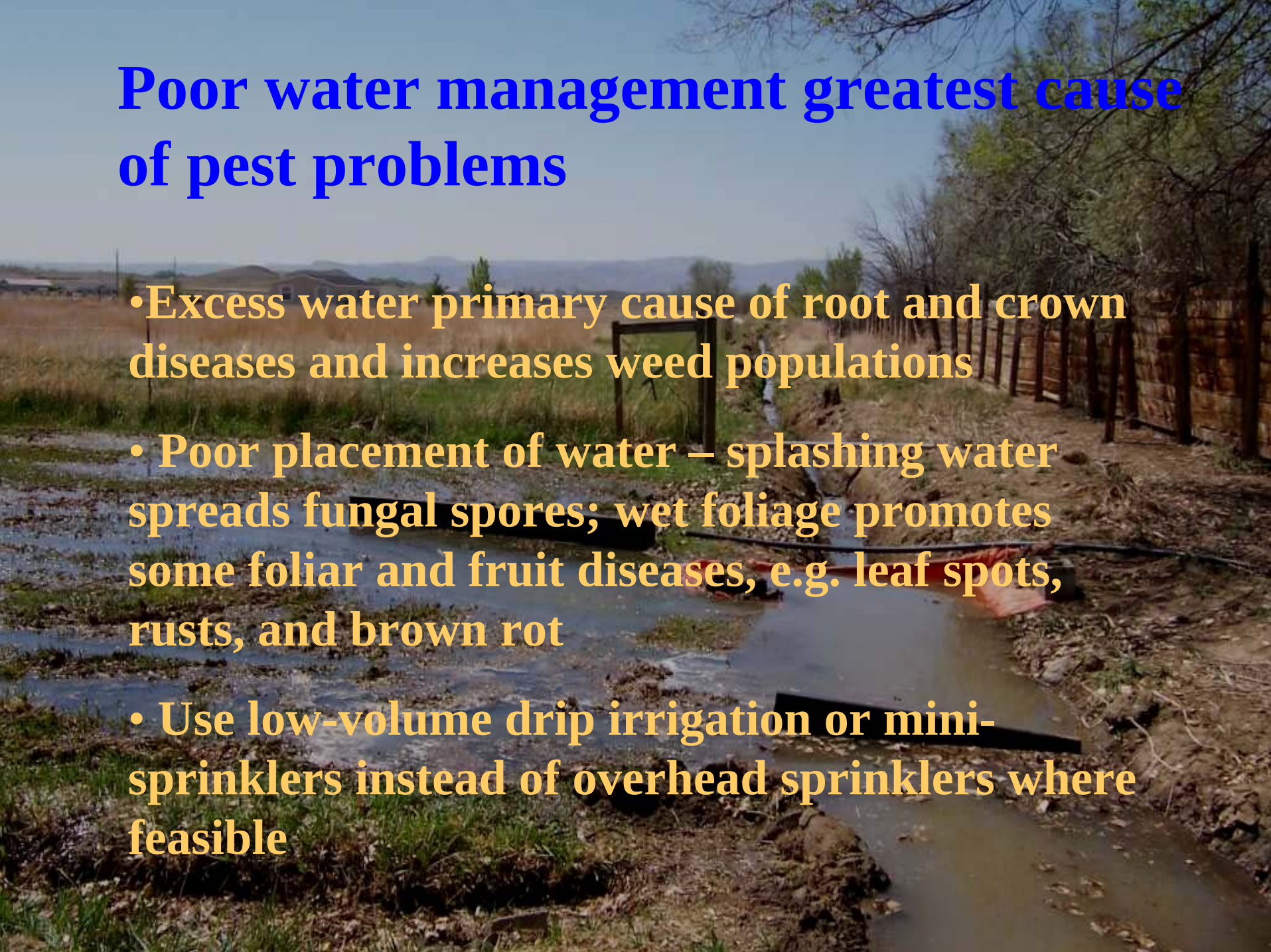
Pests: A weed, insect, disease, animal, and other organism (including invasive and non-invasive species) that directly or indirectly causes damage or annoyance by destroying food and fiber products, causing structural damage, or creating a poor environment for other organisms.



Poor water management greatest cause of pest problems

- Insufficient water causes leaves to wilt, droop, drop
- Drought-stress promotes sunburn, sunscald, shoot and branch dieback, bark cracking, cankers, and some fungi
- Beetles, mites, and chewing or sucking insects may attack drought-stressed plants.

Poor water management greatest cause of pest problems



- Excess water primary cause of root and crown diseases and increases weed populations
- Poor placement of water – splashing water spreads fungal spores; wet foliage promotes some foliar and fruit diseases, e.g. leaf spots, rusts, and brown rot
- Use low-volume drip irrigation or mini-sprinklers instead of overhead sprinklers where feasible

Pest Management – 1st Step

- Identify type and level of pest infestation (pest scouting)

- Apply treatment/control when economic threshold levels are reached

2nd Step – Explore Type of Control

1. Biological

- Introduction of exotic species of parasites and predators
- Conservation of parasites and predators
- Augmentation of parasites and predators
- Microbiological control (pathogens)

Drawbacks: may be costly; often slow and weather-dependent

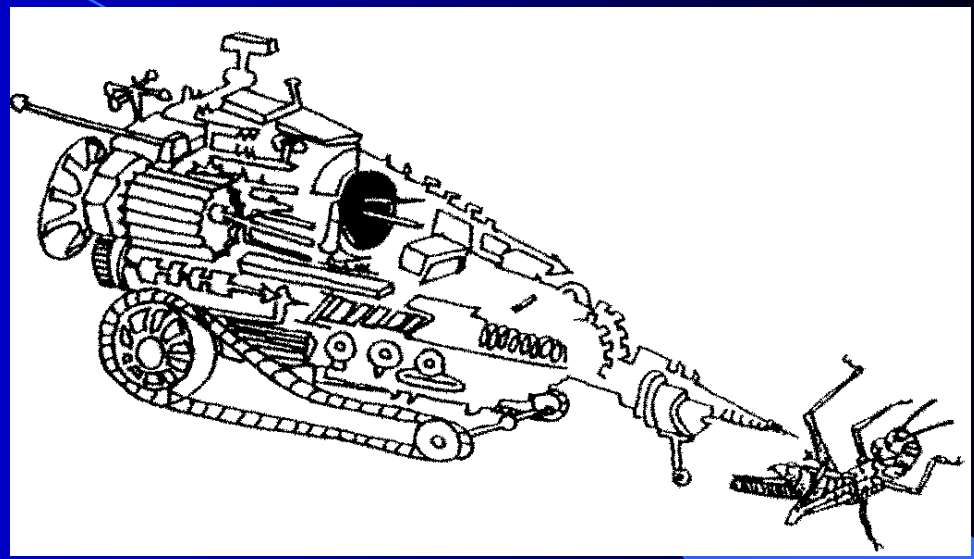
Biocontrol agents

Ladybird beetle larva and adult

Pathogens

TYPES OF CONTROL

2. Mechanical



- Hand picking
- Trapping
- Using devices like screens and barriers

Drawbacks: time- and labor-consuming, slow, often impractical at large-scale

TYPES OF CONTROL

3. Cultural

- Crop rotation – good for insects with long life cycles (e.g., corn rootworms)
- Trap crops – attracts pests; then the trap crop is destroyed or treated with insecticide
- Tillage – good for soil-inhabiting insects
- Clean culture – removal of crop residues
- Timing of planting and harvesting
- Resistant plant varieties, including genetically modified cultivars

Cultural control: advantages

- Normal farming practices, making environments unfavorable for pests
- Preventive strategy
- Economical
- Good for low-unit-value crops

Cultural control: drawbacks

- Will not work in an outbreak situation when pest infestation is heavy

TYPES OF CONTROL

4. Chemical

Reduction of pest populations or prevention of injury by the use of materials to poison them, attract them to other devices, or repel them from specific areas

Still our first line of defense despite adverse publicity

Chemical control: advantages

- Efficient
- Economical
- Fast-acting
- Easy to use
- Generally safe

Chemical control: drawbacks

- Temporary relief
- May cause resistance
- Residues in harvest
- Environment: side-effects to non-targets
- Some insecticides have direct hazards
- Residual carryover

TYPES OF CONTROL

5. Integrated (IPM)

Management of pest populations by the utilization of all suitable techniques in a compatible manner so that damage is kept below economic levels

Ecological approach to avoid economic losses and to minimize adverse effects **; most recommended**

Irrigation Land Leveling

Definition - Reshaping the surface of land to be irrigated to planned grades.

Purposes - To permit uniform and efficient application of irrigation water without causing erosion, loss of water quality, or damage to land by waterlogging and at the same time to provide for adequate surface drainage.

In addition to Irrigation Water management, leveling is essential for pest management.

3rd Step – Evaluate Environmental Risks of Alternatives (NRCS Role)

– Evaluate environmental risks associated with probable pest management recommendations

– Develop appropriate mitigation (conservation treatment) alternatives to minimize environmental risks.

NRCS Roles in Pest Management:

– Assist clients to adopt IPM that helps protect natural resources

– Assist clients to develop and implement an acceptable pest management component of overall conservation plan.

Pest Management Standard

– NRCS NM will use Windows Pesticide Screening Tool to evaluate the environmental risks using specific pesticides (Water Quality Tech. Note 9 on how to use the tool).

–WIN-PST ratings of Intermediate, High or Extra High for potential soil-pesticide interactions, losses and hazards to humans and fish on a given field require a closer look at developing an appropriate alternative combining less hazardous pesticide and conservation practices.

–Water Quality Tech Note 8 for Summary of Mitigation Options for Nutrient and Pest Management Jobsheet 595a for Conservation Treatment Techniques).

Decreasing hazards from non-point source pesticide contamination

- Pesticides can be soluble or attach quickly to soil particles
- If soluble, can move with surface runoff
- If attached to soil particles, can move offsite via erosion

Decreasing hazards from non-point source pesticide contamination

Main ways to approach hazard reduction:

- Manage pesticides differently
  - reduced rate, delayed application, substitution
- Manage crops differently
  - crop rotation, planting dates, resistant varieties
- Control off-site pesticide movement
  - Buffers, Water management, Crop residue management

Controlling non-point source pesticide contamination

Typically conservation treatment techniques:

- Reduce pesticide application lbs/acre
- Utilize less hazardous pesticides
- Prevent pesticide from moving away from point of efficacy (in field)
- Prevent pesticide from leaving field (bottom of root zone - edge of field)

Reducing pesticide application:

- NRCS does not “recommend” any pesticide, rate, formulation, or timing
- All changes in pesticide management must be done with the help of Extension and crop consultants

Reducing pesticide application:

- Integrated Pest Management
  - scouting
  - apply only when economic threshold is reached
  - use pest resistant varieties
  - use good sanitation practices
  - use crop rotation or delayed planting

Reducing pesticide application:

- Keep plants healthy and vigorous (proper irrigation water management is key)
- Use lowest effective rate
- Apply to part of the field
  - banding
  - spot treatment

Reducing pesticide application:

- Avoid treatments that rely mainly on residual activity for control
  - early pre-plant
  - fall application to control spring weeds
- Use post-emergent treatments
- Utilize directed sprays
- Use lower application rate pesticides

Reducing pesticide application:

- Use mixtures of low rate pesticides instead of a single pesticide at a high rate
  - Partial substitution
- Proper maintenance and calibration of equipment

Utilize pesticides that are less environmentally hazardous

- NRCS can help determine *at the field level*
  - Potential pesticide loss
  - Potential pesticide hazard
- NRCS *does not* make pesticide recommendations to producers
- NRCS works with Extension or other crop advisors to help them include environmental risk in their recommendations

Prevent pesticide from moving away from point of efficacy

- Pesticides which move away from their target can no longer control the pest
  - Soil Incorporation (decreases runoff)
  - Use less mobile pesticides

Prevent pesticide from moving away from point of efficacy

- Decrease drift
  - Adjusting spray equipment (droplet size)
  - Don’t apply in windy conditions
- Direct application toward target pest
  - Avoid aerial applications or mist blowers
  - Use wick applicators or other targeting technologies

Prevent pesticide from moving away from point of efficacy

- Use infield conservation techniques that
  - Slow movement of water, chemicals and soil
  - Trap sediment within the field
  - Encourage infiltration within the field
- Examples
  - *Residue Management*
  - *Farming “across the slope”*
  - *Farming “on the contour”*
  - *Contour strip crops*
  - *Contour buffer strips*

Prevent pesticide from moving away from point of efficacy

- Avoid applying pesticide before a heavy rainfall
- Practice efficient irrigation techniques
  - Minimize leaching
  - Minimize runoff
  - Time pesticide application to coincide with irrigation
  - Chemigate judiciously

Prevent pesticide from leaving field (bottom of root zone)

- Practices that decrease leaching
  - Use less pesticide
    - economic threshold
    - lowest effective rate
    - lower rate pesticide
    - Apply to less of the field (banding, spot treatment)
  - Switch to less ‘leachable’ pesticide
    - avoid using high leaching pesticide on high leaching soil

Prevent pesticide from leaving field (bottom of root zone)

Practices that decrease leaching:

- Alter the *'driver'*
  - avoid pesticide application before storms
  - manage irrigation to prevent leaching (and run-off)
- Increase filtration
  - increase soil organic matter
  - disturb surface connected macropores
- Switch to less hazardous pesticide

Prevent pesticide from leaving field (edge of field)

- Use less pesticide
  - economic threshold
  - lowest effective rate
  - lower rate pesticide
  - apply to less of the field (banding, spot treatment)
- Soil incorporate
- Practices that increase infiltration
  - On field
    - residue management
    - increasing soil organic matter

Prevent pesticide from leaving field (bottom of root zone - edge of field)

- Practices that increase infiltration (continued)
  - On field
    - maintaining soil health
    - tillage direction (contour)
    - strip crops
    - preventing/disturbing soil crusts
  - Maintain sub-surface drainage

Prevent pesticide from leaving field (edge of field)

- Catching pesticides at field edge
  - buffer (filter) strips
  - retention ponds
  - constructed wetlands
  - grassed waterways


SEVERAL NM
FIELD CROP
PESTS
©Marlin Rice

Western Corn Rootworm

***Diabrotica virgifera* - beetle**

- **The larvae attack the roots, causing the plants to fall over and become goose-necked.**
- **The adults feed on the silks and, at times, become so numerous that pollination cannot occur.**
- **Overwinter as eggs in the soil. One generation per year.**

Western Corn Rootworm

Heavy root damage

Control

- The most effective means of control is by crop rotation. Corn grown year after year on heavy soil is the most seriously damaged.

- Pesticides: do not use when rotating crops. If necessary, apply granules in a 6-7 inch bank over the row at planting time or as a cultivation treatment.

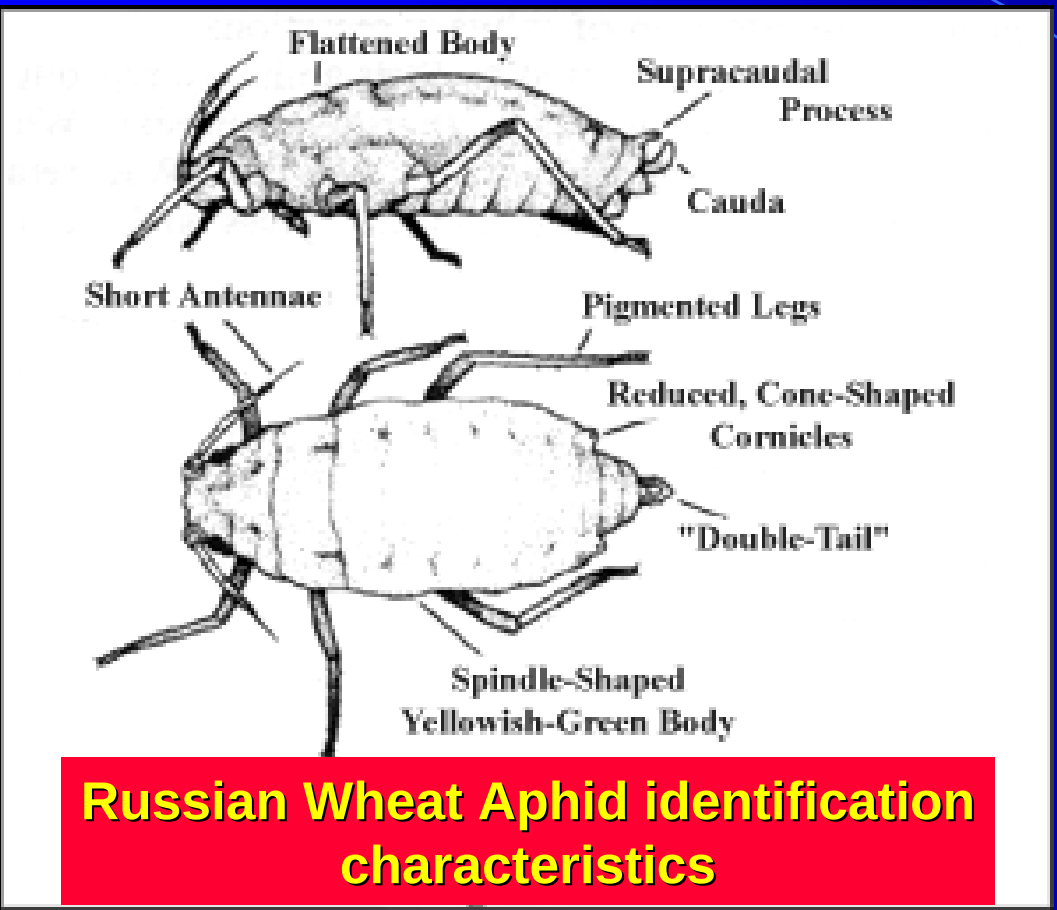
- Do not apply sprays for adults unless pollination is threatened.

Russian Wheat Aphid

Diuraphis noxia

- Native to southern Russia and the Mediterranean region.
- Introduced in the U.S. in 1986.
- Reproduces sexually or asexually.
- Several generations per year.
- Overwinter as immatures or adults in grasses.

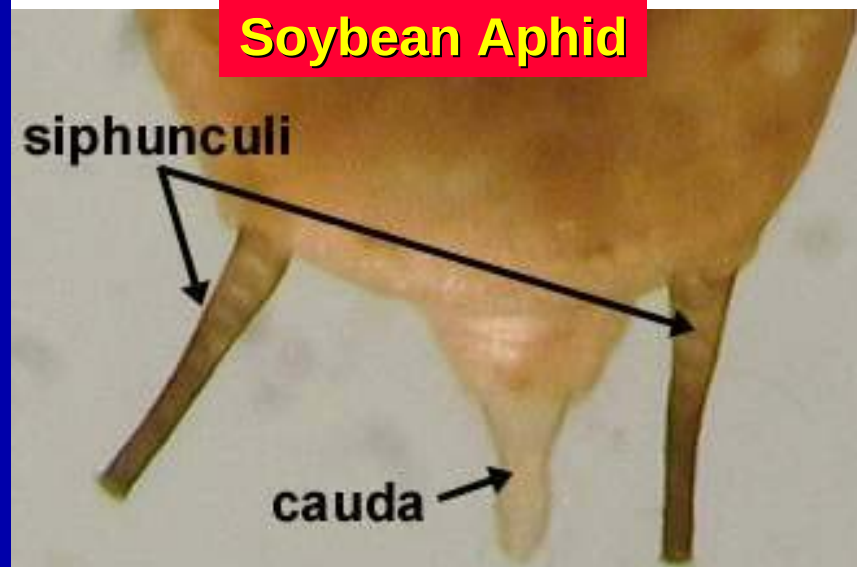
Russian Wheat Aphid



Russian Wheat Aphid identification characteristics

- Elongated
- Short antennae
- No cornicles (“tail-pipes”)
- Forked (double) tail

Soybean Aphid



Russian Wheat Aphid

Damage:

- RWA initiates feeding at the base of the leaves near the top of the plant. It injects a toxic saliva into the plant. The edges of the leaf curl inward protecting the pest.
- Plants become purplish and leaves develop longitudinal yellowish and whitish streaks.
- Tillers of heavily infested plants run parallel to the ground (a prostrate appearance).
- Heads are distorted.

Russian Wheat Aphid

Control:

- Cultural – control volunteer wheat; avoid early planting; use resistant varieties; maintain healthy stand.
- Biological – parasitic wasps, ladybird beetles.
- Chemical – foliar sprays with systemics.

Alfalfa weevil

Hypera postica - beetle

The color is brown with a darker brown stripe down the middle of the elytra.

- **The pronotum has a dark brown stripe through which runs a pale line.**
- **Adult length is about 1/4 inch (6 mm).**

Alfalfa weevil


Eggs

Larvae

- Larva is green or yellow with dark head.
- Damage: mostly by larvae. Skeletonize leaves. Feed on the foliage, especially terminal leaf buds, then drop to the ground and pupate in the litter.
- Adults overwinter. One generation per year.

Alfalfa weevil

Leaf skeletonization by larvae

- **Cultural management:** Early first harvest; fall grazing; spring burning; resistant cultivars.
- **Chemical control:** Mostly organophosphates, which are highly toxic for pollinators (bees) and other beneficials. Apply early in the morning or late in the evening.